抗黑尾葉蟬及褐飛蝨水稻品種田間觀察[1]

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一、前　言

本分所於民國59年開始檢定水稻品種對黑尾葉蟬（*Nephotettix cincticeps*）及褐飛蝨（*Nilaparvata lugens*）爲害感受性觀察，並先後由國際稻米研究所引入經該所檢定之抵抗性品種30餘種作爲比較材料。檢定工作在本分所抗蟲檢定室，以盆栽秧苗，人工接種方法實施。年來經檢定水稻達千餘品種，檢定方法及結果將另文詳加報告。本試驗則側重於核察經室內選出之抗蟲品種，在田間對上述兩種害蟲爲害之抵抗性狀。抗蟲品種，尤其自國外引入品種，在本省自然環境之適應性和其農藝性狀，以及對其他病蟲害之感受性一併觀察，俾供育種取材之參考。茲將此項試驗結果，整理成篇，報導於次，尙祈先進不吝指正。

二、材料及方法

本試驗參試水稻品種（系）共50種，其中32品種（系）自國際稻米研究所引入，8品種（系）爲本省栽培或保存者，另10種爲本分所選育之抗褐飛蝨分離品系。各品種（系）在室內檢定對褐飛蝨或黑尾葉蟬之感受性，列如表一。試驗區設置於每年褐飛蝨發生嚴重區之嘉義縣民雄鄉菁埔。水稻於59年8月2日插秧，每品種栽植三小區，小區面積爲 0.75× 2公尺，栽植50欉，單本植，逢機完全區集設計。耕作管理同一般方法，惟不施用任何藥劑，以便各種病蟲害自然繁衍滋生。移植後60天起，分期前往調查褐飛蝨及黑尾葉蟬在各品種之棲息密度以及其他各種病蟲害發生情形和農藝性狀等。以每小區中央兩行爲取樣對象，調查10欉。褐飛蝨及黑尾葉蟬之棲息密度以及各水稻品種受害程度均以目測法分等級調查，其他病蟲害發生情形則於每次調查時隨時注意，並加紀錄。

三、結果與討論

水稻在移植後，由於颱風雨接踵而來，初期發育不佳。其後經補株並仔細管理，發育狀況逐漸轉好。初期各品種除稍受稻黑稈蠅爲害外，未發其他病蟲害。迨移植後60天，除發生輕微胡麻葉枯病外，無被害跡象；而蟲害則各類飛蝨及葉蟬均見發生，但密度很低，此種現象直至移植後70天，各品種間褐飛蝨棲息密度之差異始逐漸明顯，但各品種水稻仍未見到任何受害徵象。

水稻各品種間褐飛蝨棲息密度在移植後95天，亦即大部份品種已進入乳熟期，差異極爲明顯。此時在感蟲品種，每欉水稻之棲息蟲數大部份在 300 隻以上，高者則超過1,000隻（表1）；然而抗蟲品種，褐飛蝨密度仍然很低，尤以 Ptb 21, Mudgo, Dikwee, Ptb 18, 高秈育 12, Sudurvi 306, Balamawee, Ptb 19, H 105, IR 227-7-2-31, H 5, MTU 9, Murungakayang 及 C-59-2-5 等14個品種（系）每欉水稻平均蟲數均在10隻以內。饒有興趣者，抗蟲品種與感蟲品種併排時，兩品種雖祇有 25cm 間距，而即使相間之兩排水稻褐飛蝨棲羣密度却截然不同。更値得注意者抗蟲品種與感蟲品種間褐飛蝨棲息蟲態之差異，抗蟲品種以成蟲態度較若蟲態者爲多，且多屬長翅型者；但在感蟲品種則反之。按本分所及國際稻米研究所室內試驗顯示比較上褐飛蝨不喜歡在抗蟲品種取食，若將褐飛蝨強迫置於抗蟲品種水稻則死亡率很高，而且棲羣增殖亦極爲低落（Sogawa, et. al 1970; Pathak, et al. 1969; 鄭氏 1971），因此在田間自然狀況下，褐飛蝨無法在抗蟲品種建立和感蟲品種同樣高的密度棲羣，可能爲抗蟲品種具有非嗜好性（non-preference）及抗禦性（antibiosis）所致。

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表 1　經室內檢定選出之抗黑尾葉蟬及褐飛蝨水稻品種在田間之反應觀察

Table 1. Field reactions of rice varieties screened for their resistance to *Nilaparvata lugens* and *Nephotettix cincticeps* in insectary.

品　種 Varieties	室內檢定反應 Reactions in insectary test		在移植後指定日褐飛蝨之棲羣密度 Population of BPH in indicated days after transplanting*			被害等級 Damage* (120 DAT)
	褐飛蝨 BPH	黑尾葉蟬 GLH	60	70	95	
Ptb 21	R	R	1	1	1	0
Mudgo	R	MS	1	1	1	0
Dikwee	R	R	1	1	1	1
Ptb 18	R	R	1	2	1	1
Kaosen-yu 12	MR	R	1	1	1	1
Sudurvi 306	R	R	1	1	1	1
Balamawee	R	R	1	2	1	1
Ptb 19	R	R	1	2	1	1
H 105	R	R	1	1	1	1
IR 227-7-2-31	—	R	1	2	1	1
H 5	R	R	1	2	1	1
Mtu 9	R	R	1	2	2	1
Murungakayang	R	—	1	1	2	1
C-59-2-5	R	—	1	2	2	1
Co 13	MR	MR	1	2	3	1
IR 140-136-3	—	R	1	2	3	1.5
Asd 7	R	R	1	2	3	1.5
IR 9-60	R	—	1	1	3	1.5
Co 9	MR	MR	1	2	4	1
IR 747-B-6-3	R	—	1	2	4	1.5
IR 1154-254	MR	—	1	2	4	1.5
C-59-2-4	S	—	2	2	5	2
C-59-2-6	R	—	1	3	5	2
Lung-yu	MS	R	1	2	5	2
Samba	MR	R	1	2	5	1.5
Dj 9	R	R	1	2	7	2
Kalimakuri 391	—	R	1	2	7	2
Peta	MS	MR	1	2	7	2
DS 1	S	R	1	2	5	3
DK 1	S	R	1	2	5	3

DN 27	S	R	1	2	6	3
Tainan 5	S	S	1	3	6	3
Hashikalui	S	R	2	3	7	3
DNJ 27	S	R	1	2	7	3
Taichung 184	MS	S	1	3	7	3
C-59-2-1	S	—	2	3	8	3
Taichung 170	MS	S	2	3	8	3
Su-yai 20	S	R	2	2	8	3
C-59-2-3	S	—	2	3	8	3
C-59-2-10	S	—	2	3	8	3
C-59-2-9	S	—	2	3	8	3
C-59-2-7	S	—	2	3	8	3
Chianan 8	S	S	2	3	8	3
C-59-2-2	S	—	2	3	8	3
Taitung-Lu 2	MS	S	1	3	8	3
Kaoshung 136	MS	S	2	3	8	3
C-59-2-8	S	—	2	3	8	3
DM 77	S	R	2	3	8	3
Baiang	S	R	2	3	8	3
Taichung (N)1	S	S	2	3	8	3

等級評定

Grading Scale

棲 羣 Population	每欉水稻蟲數 No. of insect per hill (approx.)
1	1
2	1.1—10
3	10.1—50
4	50.1—100
5	100.1—200
6	200.1—300
7	300.1—500
8	500 以上

被 害

Damage

0	無被害狀	(No visible damage)
1	輕微被害	(Slightly damaged)
2	中等被害	(Moderately damaged)
3	嚴重被害	(Severely damaged or completely hopper-burn

從移植後 120天調查各品種植株受害情形，顯示各品種受褐飛蝨爲害程度與褐飛蝨在該品種棲息密度呈極密切相關。棲羣密度低之品種受害程度一般較輕微，而高者則反是。然而如 Peta, DJ9及Kalim-

akuri 391等品種，褐飛蝨之棲息密度均超過300隻以上，但受害仍屬輕微，可能顯示這些品種對褐飛蝨爲害具某種程度之容忍性（Tolerance），反觀受褐飛蝨爲害嚴重之品種如DS 1, DK 1及DM 27等三品種，褐飛蝨之密度則僅有 200隻左右，這些品種對褐飛蝨爲害之容忍性顯然屬於較弱的一羣。

總括褐飛蝨在供試各品種之密度以及各品種受害程度觀察，各品種對褐飛蝨爲害反應現象，在室內的秧苗人工檢定及在田間讓褐飛蝨自然選擇繁殖爲害所得之結果相當一致，惟某些品種在室內檢定時屬於感蟲性者，如 Peta, Lung-Yu 及 C-59-2-4 等，其在田間却呈抗性。但由於褐飛蝨在這些品種（系）均具相當密度，可斷定其並非因不能在這些水稻品種的發育後期取食或生育繁殖使然，而可能爲這些品種對褐飛蝨爲害容忍性隨水稻成長而增加，亦可能是室內檢定所用褐飛蝨之棲羣密度較田間者爲高所致。這種容忍型之抵抗性，在褐飛蝨發生不太嚴重地區或年份，不失爲一優良之品種，但在褐飛蝨猖獗發生之年，若無適當藥劑保護，則難免受到嚴重損害。

黑尾葉蟬在各品種棲息密度之調查，由於小區面積受引入品種種子數量之限制而過於狹小，黑尾葉蟬稍受驚動每易越區飛躍，未便使用網掃方法調查。因此其棲息密度隨改用目測若蟲在小區之密度爲指標，惜因黑尾葉蟬在試驗期間密度一直很低，品種間差異不明顯。調查結果不另敘述。

供試水稻品種之農藝特性及對其他病蟲害之感受性列如表 2 。一般而言，引進品種除少數由國際

表 2　供試水稻品種之農藝性狀

Table 2. Agronomic characterestics of tested rice varieties

品　種 Varieties	分蘗株數 No. of tiller/hill	穗數／欉 No. of ear/hill	抽穗日期 Date of heading	株　高 Plant height (cm)	劍葉長 Length of flag leaf(cm)	劍葉寬 Width of flag leaf(cm)	穗　長 Length of ear (cm)	穗　重 Weight of ear (g)	米粒色 Colour of kernel**	倒伏或直立 Lodging or standing
Ptb 21	23.2	23	17/11	130	—	—	17.05	0.63*	R	I
Mudgo	13.8	9.6	7/10	146.2	37.1	1.73	22.91	3.28	R	—
Dikwee	10.7	—	17/10	142.0	50.9	1.45	28.97	3.40*	R	I
Ptb 18	22.6	23.5	17/10	134.7	—	—	17.85	0.93*	R	I
Kaosen-yu 12	17.6	17.9	17/10	89.5	26.4	1.56	22.93	1.95	W	I
Sudurvi 306	16.2	14.9	7/10	125.4	30	1.12	20.98	2.20	R	—
Balamawee	16.9	12	27/11	145.8	—	—	—	—	R	I
Ptb 19	16.9	20.5	11/11	125.3	—	—	—	—	R	I
H 105	12.4	12.1	27/10	157.8	23	1.81	25.05	3.65*	R	I
IR 227-7-2-31	12.9	14.3	3/11	115.8	28.9	1.48	20.95	2.18*	R	—
H 5	13.8	9.9	3/11	143.7	34.5	1.52	25.06	2.98*	W	—
Mtu 9	12.1	13.1	17/10	149.9	42.4	1.31	21.98	1.83	W	—
Murungakayang	10.4	11.4	3/11	134.5	39.8	1.65	25.65	3.42	R	—
C-59-2-5	18.8	15.1	17/10	91.6	25.8	1.55	20	1.83	W	I
Co 13	15.7	13.7	17/10	141.6	31.9	1.20	22.80	1.95*	W	—
Co 9	14.1	15.5	17/10	144.2	40.6	1.33	19.44	1.30	R	—
IR 140-136-3	10.8	—	27/10	168.6	42.7	1.64	24.31	3.20*	R	—
Asd 7	15.5	16.3	7/10	123.8	28.7	1.10	17.72	1.60	R	—
IR 9-60	20.2	14.7	27/10	86.4	19.4	1.50	20.62	1.80	W	I

IR 747-B-6-3	22.7	18.4	30/9	79.7	24.1	1.13	19.29	0.95	W	I
IR 1154-254	17.1	13.9	17/10	80.9	27.3	1.42	22.77	2.28	W	I
Peta	15.3	10.3	17/11	131.8	52	1.41	19.45	1.00*	W	I
C-59-2-4	16.9	14.4	27/10	88.8	31.4	1.56	19.43	1.50	W	I
C-59-2-6	18.8	13	27/10	100.7	30.5	1.7	23.30	2.35*	W	I
Lung-yu	13.2	14	17/11	137.2	—	1.65	18.25	1.85*	—	I
Samba	13.4	12.7	27/10	173.4	47.6	1.61	26.30	3.53	R	I
Dj 9	14.2	13.9	7/10	127.4	31.4	1.08	20.87	1.58	R	—
Kalimakuri 391	16.9	13.1	27/10	150.7	24.2	1.51	21.28	1.15	R	—
DS 1	16.8	14.2	7/10	141.9	45	0.93	24.79	1.45	R	—
DK 1	16.2	16.2	7/10	121.5	36.2	1.07	18.03	0.70*	R	—
DM 27	15.1	13.3	7/10	120.3	38.9	1.1	20.44	1.05	R	—
Tainan 5	12.3	10.3	17/10	113.7	30.8	1.12	—	—	W	I
Hashikalui	17.7	15	7/10	117.3	33.9	1.36	19.09	1.13	R	—
DNJ 27	9.4	12.7	7/10	119.3	32.7	1.7	20.15	1.73	W	—
Taichung 184	16.8	10.3	17/10	107.4	31.4	1.06	20.84	2.05	W	I
C-59-2-1	19.6	13.5	17/10	91.8	27	1.54	18.66	1.58	W	I
Taichung 170	14.3	9.1	17/10	106.1	33	1.14	—	—	W	I
Su-yai 20	18.5	17.9	7/10	96.3	20.6	1.04	15.14	0.60*	W	—
C-59-2-3	16.4	15.9	17/10	98.7	26.3	1.47	20.19	1.65	W	I
C-59-2-10	25.4	14.6	27/10	82.7	26	1.49	20.80	2.05	W	I
C-59-2-9	19.5	15.9	17/10	91.6	29.2	1.62	18.95	1.45	W	I
C-59-2-7	16.9	13.3	7/10	101.4	29.3	1.6	20.44	2.18	W	I
Chianan 8	12.4	9.6	17/10	105.3	28.1	1.16	—	—	W	—
C-59-2-2	15.5	13.4	7/10	91.3	28.2	1.62	21.38	2.10	W	I
Taitung-Lu 2	8.3	7.2	7/10	93	27.3	1.77	—	—	W	—
Kaoshung 136	14.5	9.5	27/10	98	28.7	1.92	21.36	1.63	W	I
C-59-2-8	16.8	14.9	17/10	81.3	26.1	1.38	20.27	1.25	W	—
DM 77	19.5	16.1	7/10	115.8	34.4	1.01	16.96	0.93	R	—
Baiang	16.3	12.6	27/10	118.2	30.7	1.22	22.39	1.70	W	I
Taichung (N)1	18.9	13.8	7/10	84.3	27.6	1.39	22.17	1.33	W	I

**R:Red 紅 W:White 白 ***I:Standing 直立 −:Lodging 倒伏

*The grains were not in full maturity, Dry weight 水稻未完全成熟，乾重。

稻米研究所育成之品系如 IR 9-60, IR 747 及IR 1154 較矮外，其餘株高均在 100cm 以上，因而後期倒伏乾枯者甚多。引進品種之生育日期一般亦較本省栽培品種爲長，其中以 Ptb 21, Ptb 19, Balamawee, Peta 及 Lung-yu 等品種抽穗期竟較一般品種長約30至40天左右。據許氏等 (1967) 報告，屬於低緯度之東南亞水稻，由於對日照長短的反應比較敏感，且在生長期間需要比較高温及較長的時間始能正常出穗，因此在本省一年二期水稻生長環境下，其生長日數需較本省栽培品種爲長了

。唯在引進品種中如 Mudgo, Sudurvi 306, ASD 7, DJ 9, DS 1, DK 1, DM 27, Hashikakui, DNJ 27,及 Su-yai等品種之抽穗期則與本省栽培品種如臺中在來1號等相同。引入品種另一缺點爲大部份品種之米粒顏色爲紅色，此種米色品質一般較差，雖在育種過程中紅米之缺點可以去除，但須增加手續上之麻煩，且亦減少選出抗蟲優良品種之機會。然而引入品種一般稻穗較本省品種長而且重，若能適當利用亦不失爲育種之良好材料。

在本試驗期中，蟲害除褐飛蝨發生較嚴重外，其他蟲害有電光葉蟬，黑尾葉蟬，白翅葉蟬，斑飛蝨，稻黑稈蠅及二化螟蟲等。在這些害蟲中，除水稻早期普遍遭受稻黑稈蠅輕微爲害外，其他發生密度很低。病害方面除少數品種外，一般均罹胡麻葉枯病及紋枯病爲害。在供試品種中遭受胡麻葉枯病爲害較重者有 Lung-yu, DNJ 27 及 Baiang 等三種，遭受紋枯病中等爲害者有 Mudgo, Co 13, ASD 7, IR 9-60, DJ 9, Hashihalui, 170 臺中 Su-yai, C-59-2-7,DM 77 及 Baiang等，而較重者有 IR 1154, DK 1,臺南5號，DNJ 27及高雄136號等。另據其他試驗觀察 ASD 7 對稻熱病之感染極爲敏感。

就本次試驗結果顯示由室內選出之抗蟲品種在田間確有防治褐飛蝨爲害之功效。惜目前本省栽培品種均屬於感蟲類型者，而國外引入品種雖具抗蟲特性，但因其適應性，農藝性狀或產量品質等之關係而未能直接推廣農民栽植。可喜的是本分所以臺中在來1號×（C230X Mudgo） 育出之雜交後代，某些系統如 C-59-2-6, C-59-2-5 及 C-59-2-4 等在本次試驗中亦顯示其優良之抗蟲特性，而且這些系統之植株性狀矮小叢生，極合乎本省栽培要求。目前水稻抗褐飛蝨（或黑尾葉蟬）特性，已被證實爲一顯性因子所控制之可遺傳性狀（張氏， 1970; IRRI, 1968, 1969; Pathak, et. al. 1969; Kaneda, 1970）許多抗蟲雜交組合正在本分所繼續選拔觀察中。按目前試驗進展，預期在最近將來，當可育出一優良抗褐飛蝨而豐產的品種，推廣農民栽培，此則非但可減少每年因防治此一嚴重害蟲所花費之藥劑及人工費用，亦可減少因藥劑所引起之種種不良後果。

四、摘　　要

本試驗之目的，在於核察經室內選出之抗褐飛蝨及黑尾葉蟬水稻品種在田間自然狀態下對上述兩種害蟲之抵抗性狀。抗蟲品種，尤其是國外引入品種，在本省自然環境之適應性和其農藝性狀，以及對一般病蟲害之感受性一併觀察，俾供育種取材之參考。試驗結果可歸納爲如下數點：

1.經室內以盤栽秧苗，人工接種方法檢定選出之抗褐飛蝨品種（系），在田間亦顯示其高度之抵抗性。當褐飛蝨棲羣密度隨水稻感蟲品種生長成熟而迅速增高時，在抗蟲品種（系）之棲羣密度則呈緩慢之增進或一直保持很低，因而抗蟲品種（系）在感蟲品種受害極嚴重或枯萎時，其受害程度仍很輕微。此種結果顯示水稻對褐飛蝨爲害之感受情形，秧苗期與成熟期大體一致。

2.黑尾葉蟬善於飛躍，而發生密度很低，因小區面積過於狹小，影響調查準確性，其結果是否如褐飛蝨同樣明顯，有待證實。

3.由國外引入之抗蟲品種一般植株較高，容易倒伏，其生育期因品種對日照長短之反應，差異很大，如 Mudgo, ASD7,…………及 DM 27等品種之抽穗期與臺中在來1號相同，但如 Ptb 19, Ptb 21, Balamawee 及 Peta 等品種則較一般品種長約30至40天左右。引入品種除少數外，大部份品種米粒呈紅色，米質較差。但其稻穗則大部顯較本省者爲長而且重。

4.除褐飛蝨外，其他病蟲害發生密度很低。所有供試品種早期均遭稻黑稈蠅輕微的爲害，中後期則大部遭受胡麻葉枯病及紋枯病侵害。其中受紋枯病爲害較重之品種有IR 1154, DK 1, 臺南5號、DNJ 27 及高雄136等。

5.本分所以臺中在來1號×（C230xMudgo） 雜交後代之某些系統如 C-59-2-5, C-59-2-6及 C-59-2-4 等，在本試驗中亦顯示其抗蟲優越特性，且其植株性狀矮小叢生，爲極具希望發展爲抗蟲豐產之水稻品種。

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FIELD REACTIONS OF RICE VARIETIES SCREENED FOR THIER RESISTANCE TO *NILAPARVATA LUGENS* AND *NEPHOTETTIX CINCTICEPS* IN INSECTARY

By

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Summary

Fifty rice varieties (or lines) known their reactions to brown planthopper (*Nilaparvata lugens*) or rice green leafhopper (*Nephotettix cincticeps*) from insectary tests were determined for their reactions in field conditions from August to December 1970. The adaptability of exotic resistant varieties to the cultivatied conditions of this island, agronomic characterestics and the reactions of tested rice plants to the other insect and disease pests were also observed in this test. Some essential results are summarized as follows:

1. The rice varieties (or lines) screened for their resistance to brown planthopper in the insectary with tray-planting, artificial infestation method generally were also shown their outstanding resistant characterestics in the field conditions, While the density of

brown planthopper population were rapid increase with the maturity of rice plant of susceptible varieties it either remained very low or increased very slow in the rice plant of resistant ones (Table 1.). As the result of that state, there were no visible damage or barely noticeable symptoms of damage in the rice plant of resistant varieties when the susceptible varieties were heavily damaged or hopperburned. However, some classified as susceptible varieties in the insectary test, such as peta, Lung-yu and C-59-2-4, were damaged moderately in the field conditions. It might reveal that the plant of those varieties had certain degree of tolerance to the insect attack or the susceptibility of those varieties in seedling stage were different from that in the matural stage. The reactions of tested varieties to the rice green leafhopper were not noticeable because of the population of the species was very low during the observation period.

2. With a few exception, the majority of exotic rice varieties tested had more panicle numbers, loager culm, longer and weightier grain panicle and later maturity (longer vegetative growth phase) than the local varieties, and the colour of kernel of these varieties were red. Although none of these exotic varieties tested could be recommended for commercial planting in Taiwan because of either for their photosensitive character, low yield ability or poor quality, however, there were many desirable characters could be introduced into Taiwanese varieties through hybridization breeding, such as panicle numbers, length and weight of panicles and especially on their hoppers resistant characters.
3. During observation period, except brown pranthopper, the insect pests population were low and the damage on each tested varieties were not different remarkably. However, the plants generally infested by brownspot (*Cochlioblous miyabeanus*) and sheath blight (*Corticium sasakii*) diseases in later stage. The damage of brown spot disease on tested varieties were not different remarkably, but some varieties, such as IR 1154, DK 1, DNJ 27, Tainan 5 and Kaoshiung 136 etc. were infested with sheath blight severely.
4. Among 10 hybrid lines selected from T(N)1X (C230 X Mudgo) observed in this tests, C-59-2-5, C-59-2-6 and C-59-2-4 exhabited their outstanding characteristics in resistance to brown planthopper as their parent variety, mudgo. Besides, these hybrid lines had desirable plant type short stature, stiff straw, short and upright leaves. The yield-potencial of these promissing lines are now under observation in this Station.